THE EFFECT OF AUDITORY AND VISUAL MOTION PICTURE DESCRIPTIVE MODALITIES IN TEACHING PERCEPTUAL-MOTOR SKILLS USED IN THE GRADING OF CEREAL GRAINS

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This is to certify that the

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THE EFFECT OF AUDITORY AND VISUAL MOTION PICTURE MODALITIES IN TEACHING PERCEPTUAL-MOTOR SKILLS USED IN THE GRADING OF CEREAL GRAINS

presented by

JAMES WILLIAM HANNEMANN

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Guy E. Timmins
Major professor

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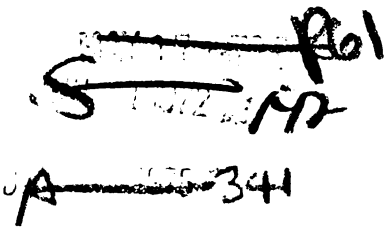

Abstract

THE EFFECT OF AUDITORY AND VISUAL MOTION PICTURE DESCRIPTIVE MODALITIES IN TEACHING PERCEPTUAL-MOTOR SKILLS USED IN THE GRADING OF CEREAL GRAINS

James William Hannemann

Problem: This study was designed to answer the following problem:

"When using motion pictures to demonstrate perceptual-motor skills, do students learn to imitate the skills demonstrated more accurately when the supportive descriptive terminology is presented auditorily or when the supportive descriptive terminology is presented visually?"

Procedure: Two operational hypotheses were developed to serve as the bases for the empirical testing of the problem statement.

Operational Hypothesis Number One

The group of students viewing the visual motion picture supportive descriptive modality will have a significantly higher mean score, at the .05 level, than the group viewing the auditory motion picture supportive descriptive modality as judged by verbal responses to questions of apparatus identification posed by the examiner following Part I of the measuring instrument.

Operational Hypothesis Number Two

The group of students viewing the visual motion picture supportive descriptive modality will have a significantly higher mean score, at the .05 level, than the group viewing the auditory supportive descriptive modality as determined by immediate imitation of the tasks described and shown by the motion picture and judged by the examiner following Part II of the measuring instrument.

Population and Sample

Using a population of 87 males enrolled in the 1967 First Term of the Agricultural Production Program, Institute of Agricultural Technology, College of Agriculture and Natural Resources, Michigan State University, 60 students were selected by simple, non-replacement random sampling. From these 60 students, 30 students were randomly assigned to the control (auditory) group and 30 students randomly assigned to the experimental (visual) group.

Selection of the Perceptual-Motor Skill

After viewing the students' backgrounds and the courses they were taking while enrolled in the Agricultural Program in the Fall of 1967, to determine the type of perceptual-motor skill which would be most beneficial to them and to post-high education in agriculture, a set of perceptual-motor skills was selected. The set consisted of those perceptual-motor skills necessary to determine the test weight per bushel of cereal grains. Consequently, a six minute, color 16mm motion picture, "Determining the Test Weight Per Bushel of Yellow Corn", was produced by the Michigan State University Film Production Unit. One mode of the motion picture had the supportive descriptive terminology in visual (captions) form and the other mode of the motion picture had the supportive descriptive terminology in auditory (spoken) form.

Measuring Instrument

A measuring instrument consisting of (1) verbal identification of the parts of the apparatus used in determining the test weight per bushel and (2) imitation of the motor tasks demonstrated in the film was constructed. It was pre-tested and found to have content validity and the power to discriminate among students.

Data Collection

Each student viewed the film in the presence of the examiner and the dependent variable data were collected immediately after the projection of the motion picture. These data were collected during a nine day period in November, 1967. All the students took the College Placement Test and the Differential Aptitude Test during fall term registration and these data were used as the independent variable data in determining relationship between student characteristics and their performance as judged by the measuring instrument.

Analysis

One way analysis of variance was used to determine if the difference between the mean scores of the control group and the experimental group, as determined by the measuring instrument, was significant at the .05 level. Product-moment correlation was used to determine the relationship between the students' scores on the College Qualifying Test...Michigan State University Norms and National Freshman Norms...and the Differential Aptitude Test...Numerical and Mechanical Sections...and their scores on Part I and II of the measuring instrument.

Findings:

1. Operational Hypothesis #1 was accepted and it was concluded that the visual descriptive supporting modality was more effective than the auditory descriptive supporting modality for identification of the parts of the apparatus.

2. Operational Hypothesis #2 was not accepted and it was concluded that the visual and auditory descriptive supporting modalities were equally effective in teaching students to imitate perceptual-motor skills demonstrated by motion pictures.

3. The only positive relationship, .5 and larger, was between the level of the students' scores on the College Placement Test...NF norms, and the numerical section of the Differential Aptitude Test and the students' performance as measured by the Part II of the measuring instrument.

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By

James William Hannemann

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Biographical Sketch

JAMES WILLIAM HANNEMANN was born at Freeman, South Dakota, on March 12, 1937, and received his elementary education in the rural schools of Hutchinson and McCook Counties, South Dakota. He graduated from the Bridgewater High School, Bridgewater, South Dakota, in May, 1955, and entered South Dakota State University in September, 1955. In June, 1959, he received a Bachelor of Science Degree in Agricultural Education from South Dakota State University, Brookings, South Dakota.

Starting in July, 1959, he taught vocational agriculture at Creighton, Nebraska, until June, 1962. He entered Cornell University in September, 1962, as a candidate for a Master of Science Degree. Completing residence requirements in June, 1963, he became teacher of agriculture at Ipswich, South Dakota, in July, 1963. He received his Master of Science Degree in February, 1965, and completed two years as teacher of agriculture at Ipswich on June 30, 1965.

In the fall of 1965, he enrolled in the Graduate School at Michigan State University and received a Doctor of Philosophy Degree in June, 1968, with a major in Vocational-Technical Education and minors in General Education and Instructional Media and Materials.

He and Kay Armstrong were married on June 14, 1959, and they have two daughters, Pamela Jane was born on April 15, 1960, and Heather Ann was born on May 3, 1963.

Acknowledgments

Appreciation is expressed to the following individuals for their assistance in the development and implementation of this study:

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Special appreciation is expressed to the members of my immediate family; Kay, Pam, Heather, Father, Mother, and Brother who gave much of themselves towards the attainment of this personal goal of which this

thesis is only a small part.

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Chapter I

Problem, Literature Review, and Hypothesis

This study is a quest for valid information which can be used by instructional specialists designing instructional media and materials for vocational education. It focuses on a problem growing out of the investigator's experiences as a teacher of agriculture and as an instructional media and materials company representative.

While attending vocational education conferences in 1965 and 1966, the writer became aware of how secondary vocational teachers perceive the utilization of motion pictures in the teaching of perceptual-motor skills. His end-of-the summer report of 1966 stated:

> "Teachers of agriculture are very interested in 8mm film loops as a possible means of teaching concepts and skills. They are especially interested in using the short films to teach mechanical skills such as adjusting the combine cylinder, identification of tools and machine parts, and similar skills. Their biggest reservation toward the use of available and potential film loops is the lack of sound to accompany the film. Apparently the teachers have preconceived notions regarding the teaching effectiveness of silent film as compared to sound film. They prefer sound film." (5)

After returning to Michigan State University in the fall of 1966, the writer attempted to determine if the teachers' perceptions about the effectiveness of the silent film as compared to the sound film was based on sound psychological theory. A problem statement was developed which gave direction to the search and which presented possibilities of empirical testing if such procedures were needed to answer the question.

Problem Statement

The problem which this study attempted to answer was:

"When using motion pictures to demonstrate perceptual-motor skills, do students learn to imitate the skills demonstrated more accurately when the supportive descriptive terminology is presented auditory or when the supportive descriptive terminology is presented visually?"

In attempting to find an answer to the problem, a review of literature was conducted to determine what research had been conducted that could provide an answer to the problem or give direction for additional research designed to solve the problem.

Definition of Terms

For the purposes of this study, the following definitions are pertinent and relevant:

Perceptual-Motor Skill: A performance involving sensory-motor processes and their coordination in executing an action or series of action.

Auditory Modality: The use of the spoken word for providing the necessary descriptive and/or explanatory data needed to support the motion picture's visual images.

Visual Modality: The use of written captions for providing the necessary descriptive and/or explanatory data needed to support the motion picture's visual images.

Control Group: The group of students shown the auditory modality.

Experimental Group: The group of students shown the visual modality.

H_0: Null Hypothesis

H_1: Alternative Hypothesis

$X < Y$: X is less than Y

$X \geq Y$: X is equal to or greater than Y

X_c: Control Group (audio)

X_e: Experimental Group (visual)

μ: Mean

df: Degrees of Freedom

Literature Review

The relationship of visual and auditory modalities to cognitive learning was investigated prior to the beginning of the twentieth century, Munsterberg and Bigham (11:34) of the Harvard Psychological Laboratory conducted one of the early studies to determine the effectiveness of information transmission systems. Their report in the 1894 Psychological Review concluded that the visual modality was superior to the auditory modality in teaching students to identify colors and numbers.

Additional studies were conducted during the latter part of the nineteenth century and during the first half of the twentieth century. T. L. Krawiech in the 1946 Journal of General Psychology reviewed the studies conducted since the completion of the Munsterberg and Bigham experiment. He reviewed Whitehead's study of 1896, Quantz's experiment in 1897, Calkin's efforts in 1898, McDougall's research of 1904, Burtt and Dobell's research of 1925, Reed's investigation of 1931, Worcestor's study of 1925, Russell's research of 1938, Stanton's experiment of 1934, DeWick's investigation of 1935, and Elliott's study of 1936. After reviewing these 11 studies, Krawiech concluded there was no general agreement as to which modality was superior in cognitive aspects of learning. (9:179)

Dr. Krawiech conducted this comprehensive review as a preliminary step to testing the prevailing opinion of the 1940's that auditory transmission was superior to visual transmission for the retention of advertising materials. After completing his study, he concluded that the visual modality of presentation was superior for learning both nonsense syllables

and nouns when the evaluation was based on the criteria of error and trial. (9:179)

In 1964, A.M.W. Travers reported the results of his investigation of the relative efficiency of information transmission systems. His literature review included many of the studies that Krawiech reviewed in 1946 but it also included studies that had been completed after 1946. On the basis of the data gleaned from the literature review, Travers concluded that:

> "A combined visual and auditory presentation of materials leads to a more efficient comprehension than the presentation of either auditory or visual methods alone". (13:6.12)

Many of the studies included in the Travers' literature review had found it difficult to maintain experimental control of the dependent and independent variables. And since the studies reviewed were forming the basis for much of what was, and still is, advocated in the design of audio-visual systems, Travers conducted similar studies with adequate experimental and statistical control.

These studies were conducted at the University of Utah and attempted to repeat the essence of the earlier studies. The results, however, failed to indicate any particular advantage of either the visual or auditory sensory channel. (13:6.23)

This conclusion tends to support his theory of perception and communication which assumes that only one set of information can enter the sensory transmission system at a time. This implies that when the nervous system is receiving information through one sensory channel, it blocks out information received through other sensory channels until the mind

has disposed of the data already transmitted.

Up to this point, this literature review has focused upon studies using nonsense syllables, single words, or other meaningless information for the subject content. From this point forward, the review will focus upon the transmission of meaningful information using media available for classroom instruction.

When assigned the task of presenting principles of equipment design to a large industrial technical staff in England, Mr. W. F. Carely compared the merits of various communication systems using an empirical approach. Designating an M Value of 0.13 as a coefficient of poor communication and an M Value of 0.2 as a coefficient of good communication, Carely assigned captioned silent films an M Value of 0.3 and "talkies" an M Value of 0.25 . Moreover, he concluded that errors of communication can be reduced by simultaneous use of more than one channel of communication, e.g. eyes and ears. (1:86) This study, therefore, tends to agree with Travers' statement based on his literature review but conflicts with Broadbent's theory and supporting research.

Edgar Dale, J. P. Finn, and C. F. Hoban summarized the studies of Einbecker (1933), McClusky (1924), McClusky and McClusky (1924), Mead (1926), and Westfall (1934), all of which investigated the effectiveness of sensory modalities using motion pictures as the carrier. They concluded that oral commentary (audition) tends to be more effective than captions (visual). (2:251)

D. J. Goodman investigated the effectiveness of (1) sound motion pictures, (2) silent motion pictures, (3) sound filmstrips, and (4) silent

filmstrips with captions in teaching safety topics in sixth and seventh grade classes. The silent modality and the sound modality contained the same pictorial and verbal material. And in tests of immediate learning, he found small, but reliable, differences in favor of the silent motion picture as compared to the sound motion picture and the sound filmstrip. Goodman also found smaller, but statistically reliable, differences in favor of the silent filmstrip when compared to the sound motion picture and the sound filmstrip. In delayed measures of learning administered 30 days later, the silent filmstrip lost it advantages over the sound motion picture and the sound filmstrip. (4:358)

McBeath compared the effectiveness of four filmic methods; captioned filmstrip, captioned filmstrip with narration, sound filmstrip, and filmograph in presenting identical facts and concepts. He concluded that matched groups of sixth-grade students learn equally well from either of the four filmic methods as determined by an immediate post-test and also on a retention test given three weeks later. (10:20)

P. E. Vernon's experiment comparing films and filmstrips for teaching the taking of soundings to British naval trainees supports the conclusions stated by Goodman and McBeath. A 25 minute sound film was compared with a 140-frame, captioned filmstrip which was adapted from the sound film. Both modalities were used to supplement the usual classroom instruction. (7:6-27)

Sumstine, on the other hand, found that verbal accompaniment was positively detrimental in film instruction but his investigation and resulting conclusion must be judged by the limitations of his measuring

technique. Although his study may not have been a valid investigation, its findings causes one to seek additional information before answering the problem statement. (12:237)

In searching for an answer to the problem statement, a review of the literature reveals that researchers have attempted to seek an answer to the same problem for over 70 years. And the answer still remains muddled. Therefore, the investigator turned to empirical procedures in an effort to find an answer to the problem statement. The problem statement was broken into testable hypotheses which are described in the next section.

Hypotheses

In order to empirically test the problem statement, it was transformed into a research hypothesis, then into an operational hypothesis and its alternative and null statistical forms following the hierarchy suggested by Joseph E. Hill's and August Kerber's Models, Methods, and Analytical Procedures in Educational Research. (6:26)

Research Hypothesis

The research hypothesis for this study is as follows:

> The type of descriptive motion picture modality influences the effectiveness of perceptual-motor skill motion picture demonstrations.

This hypothesis, concurring with the literature review findings, assumes that one of the sensory modalities is more effective than the other sensory modality. Which of the two major sensory modalities is more effective is predicted in the following operational hypothesis:

Operational Hypothesis Number One

The group of students viewing the visual motion picture descriptive modality will have a significantly higher mean score, at the .05 level, than the group viewing the auditory motion picture descriptive modality as judged by verbal responses to questions of apparatus identification posed by the examiner following Part I of the measuring instrument.

Alternative Hypothesis Number One

$H_1 = \mu_c < \mu_e$

Null Hypothesis Number One

$H_1 = \mu_c \geq \mu_e$

Operational Hypothesis Number Two

The group of students viewing the visual motion picture descriptive modality will have a significantly higher mean score, at the .05 level, than the group viewing the auditory motion picture descriptive modality as determined by immediate imitation of the tasks described and shown by the motion picture and judged by the examiner following Part II of the measuring instrument.

Alternative Hypothesis Number Two

$H_1 = \mu_c < \mu_e$

Null Hypothesis Number Two

$H_1 = \mu_c \geq \mu_e$

Assumptions

Certain conditions in the implementation and interpretation of an experimental study must be assumed and the following three assumptions are considered applicable to this study:

1. The designation of the control and experimental groups as experimental groups when discussing the study with the students who took part in the study will minimize the Hawthorne Effect.

2. It is assumed that if a difference between the two modalities does exist at the .05 level, it is statistically and educationally significant.

3. The addition of articles such as the, a, and, etc.. to the auditory supportive descriptive terminology will not cause the auditory modality to be more or less effective than the visual modality.

Limitations

The conclusions and resulting implications of this study are subject to certain limitations. First, restricting the scope of the study to those perceptual-motor skills used to determine the test weight per bushel of yellow corn restricts the conclusions and implications to perceptual-motor skills that have the same characteristics of those used in this study. Also, the measuring instrument used to determine the effectiveness of the two modalities had certain limitations. It was not possible to fully establish its reliability or its validity. Consequently, the findings and applications to teaching procedures must be restricted by the reliability and validity of the measuring instrument.

The instructional design of the motion picture followed a specific learning pattern and thereby, imposes a limitation upon this study. For if the information had been presented in a "part to whole" pattern rather than a "whole to part" pattern, the results may not of been the same. Therefore, the conclusions, implications, and recommendations are limited to the use of motion picture perceptual-motor skill demonstrations following the "whole to part" learning pattern.

In addition to the limitations of the type of skill, the type of measuring instrument, and the learning pattern, the implications are limited to those populations that are similar to the one used in this study.

Chapter II

Methodology-Data Collection

The purpose of this chapter is to describe the methodology-data collection procedures in sufficient detail to enable another investigator to duplicate this study. Therefore, this chapter describes the population and the reasons for its selection, the sample and its characteristics, the experimental design, the development of the motion picture, the data collection procedures, and the statistical treatment of the data.

Methodology

Population

The population consisted of 87 males enrolled in the 1967 Agricultural Production Program, First Term, Institute of Agricultural Technology, College of Agriculture and Natural Resources, Michigan State University, East Lansing, Michigan. These 87 males were enrolled in the Program on November 5, 1967, and had taken the College Qualifying Test and the Differential Aptitude Test on the assigned date.

In order to determine if the population identified in this study was similar to a larger population, and thereby increasing the validity of this study, it was compared to the 1965 and 1966 First Term Agricultural Technology students. The mean percentile for each year's group on the College Qualifying Test and Differential Aptitude Test is shown on Table I.

Table I Comparison of 1965, 1966, 1967, First Term Institute of Agricultural Technology Agricultural Production Students

	STUDENT MEAN PERCENTILE RANKING ON COLLEGE QUALIFYING TEST		STUDENT MEAN PERCENTILE RANKING ON DIFFERENTIAL APTITUDE TEST-12th GRADE NORMS	
Year	National Freshman Norms	Michigan State University Norms	Mechanical	Numerical
1967	21.6	7.9	57.0	50.0
1966	19.1	6.0	48.1	38.3
1965	(data not available)		54.8	47.1

Table I indicates that the 1967 population is very similar to the 1965 and 1966 population according to the College Qualifying Test percentiles. In terms of the Differential Aptitude Test percentiles, there is less than three points difference between the 1967 and 1965 students while the 1966 students have a lower mean percentile. Even so, it is concluded that the 1967 students are a valid representation of the students who had enrolled in the Agricultural Technology Program during the past two years. Consequently, the population used in this study is representative of a much larger population than from which the study's sample was drawn.

Population Selection Rationale

The population was selected because it constituted a homogeneous group of students having common goals and living in the same dormitory complex. Because the students were living in the same dormitory complex, the collection of data was facilitated within a short period of time. And this minimized the internal sources of invalidity such as maturation, mortality, and history. (:178)

Sample

The sample consisted of 30 population students assigned to the audio (control) group and 30 population students assigned to the visual (experimental) group. They were selected by simple, nonreplacement, random sampling of the population. Six additional students, three assigned to each group, were selected by the sampling procedure mentioned above. These students served as a replacement group for the control and experimental groups.

As stated above, the students comprising the control and experimental groups were drawn from the population by unrestricted, nonreplacement random sampling procedures. The principle of randomization states "since...every member of a population has an equal chance of being selected, members with certain distinguishing characteristics (will) be counterbalanced in the resulting samples". There is, however, always the possibility, although remote, of drawing a sample that is not representative of the population.

In order to determine if the sample was representative of the population, the control group and the experimental group were compared with each other and with the population. Table II shows the mean percentiles of the population, the control group, and the experimental group on the College Qualifying Test and Differential Aptitude Test.

Table II Population, Control Group, and Experimental Group Percentile Means

TEST	POPULATION	CONTROL	EXPERIMENTAL
College Qualifying			
MSU Norms.....	8.1	6.5	6.4
National Norms.....	21.8	19.7	21.0
Differential Aptitude			
Mechanical.....	56.8	55.1	57.5
Numerical.....	49.4	48.3	48.7

The percentile means of the population, the control group, and the experimental group for each category are not identical and the difference, although less than 2.5 difference at the extreme, may be significant. To determine if the difference between the appropriate percentile means was significant at the .05 level, a one-way analysis of variance was calculated for each appropriate Table II comparison. The difference between any of the comparisons was not significant at the .05 level. Therefore, it was concluded that the groups are true representatives of the population.

Experimental Design

Educational experimentation, for the purposes of this study, means a scientific investigation where the investigator manipulates and controls one or more independent variables. He then observes the influence of the independent upon the dependent variable. There are many models of experimental design and Campbell (3:195) and Kerlinger (8:303) classify experiments in education into pre-experimental, true-experimental, quasi-experimental and ex-post-facto experimental design.

In order to facilitate the selection of the experimental model, the following characteristics of this study were identified as follows:

1. A homogeneous population
2. Two independent variables
3. An unusual measuring instrument
4. Subject content not included in the population's program of study
5. Limited exposure and testing time.

With these characteristics in mind, the true-experimental design, Post-Test Only Control Group, was selected. The basic elements of this design are: (1) randomization, (2) treatment, and (3) post-test. A paradigm of this design is presented in Figure I.

Figure I Paradigm of the Post-Test Only Control Group Design

Randomization of Population	Group	Type of Modality	Post-Test
	Control	Audio	Immediate Recall
	Experimental	Visual	Immediate Recall

Selection of the Motion Picture Content

Because the primary purpose of this experiment was to test the effect of two sensory modalities — visual and auditory — upon the development of perceptual-motor skills using motion pictures as the teaching method; the exact nature of the content matter was of little importance, nevertheless, a content area had to be identified.

In selecting the subject matter content of the motion picture demonstration, the following items were considered:

1. In what courses would the population be enrolled during the term the experiment would be conducted?
2. The availability of subject matter consultant assistance.
3. The contribution of the motion picture to the improvement of post-secondary instruction.
4. The investigator's familiarity with possible subject matter areas.

After due consideration of various alternatives, the topic "Determining the Test Weight Per Bushel of Yellow Corn" was selected for the following reasons:

1. Nearly all the students had an agricultural background and therefore, were assumed to be familiar with the purpose of grain grading.
2. All the students, during the experimental period, were enrolled in Crop Science 2, Cereal Crops, in which the importance of grain grading was discussed and some phases demonstrated to the students. But the students did not become physically involved in any phase of grain grading.
3. The use of the United States Department of Agriculture Official Weight Per Bushel Tester was not demonstrated to the students nor were they exposed to the tester before the experiment in their Institute of Agricultural Technology course of study.

4. Consultant assistance for the development of the content and grading sequence was available from the United States Department of Agriculture; the College of Agriculture and Natural Resources, Michigan State University; the Michigan Crop Improvement Association; and from commercial grain handling companies.

5. In 1965, the United States Office of Education commissioned the development of a Two-Year, Post-High School Curriculum for Grain, Feed, Seed and Farm Supply Technology but did not provide funds for the development of supportive instructional materials. A number of agencies are developing appropriate instructional materials to supplement the curriculum and this study will contribute to the availability of such materials.

6. The investigator's familiarity with the content and the procedures has been developed through many years of teaching vocational education courses and in cooperative activities with country elevators and major grain marketing companies.

Development of Measuring Instrument

After the selection of the demonstration topic, a measuring instrument was developed. Using the consultative services of the United States Department of Agriculture, Consumer and Marketing Service, Grain Division, Chicago and Toledo Offices; Manager - Grain Development, Quaker Oats Company; and the Executive Secretary of the Michigan Crop Improvement Association; a list of behavioral objectives to be followed in determining the test weight per bushel were identified. These behavioral objectives are listed on page 20. The behavioral objectives were divided into two groups, (1) identification of the parts of the apparatus, and (2) the immediate imitation of the motor skills necessary to arrive at the test weight per bushel. The measuring instrument, found in Appendix A, consisted of (1) six identification questions on the parts of the apparatus which related to Hypothesis Number One and (2) eight measures of task performance which related to Hypothesis Number Two.

At the time of the study, it was not feasible to determine if one part of the apparatus was more difficult to learn than another part of the apparatus. Similarly, it was not possible to identify the degree of difficulty of imitating the performance tasks demonstrated in the motion picture and to assign discriminatory values to each task. Each identification question and performance task, therefore, was assigned a numerical weight of ten points for correct identification or task performance. Five points were given for partial correctness and zero points for complete incorrectness. If a subject correctly identified all the parts and completed all the tasks, he would receive a perfect score of 140 points. The criteria for each identification and performance task level are shown in Appendix A.

Determination of the Validity of the Measuring Instrument

For the purpose of this study, the determination of the measuring instrument's validity was limited to content validity with the realization that construct, predictive, and concurrent validity would normally be determined if sufficient time, financial resources, and personnel were available.

In order to determine the content validity, an outline of the behavioral objectives of the motion picture and the measuring instrument's performance standards were compared.

BEHAVIORAL OBJECTIVES	MEASURING INSTRUMENT'S PERFORMANCE STANDARDS
After viewing the film, the student should be able to verbally identify the following apparatus' parts using the terminology listed:	The student will be asked to verbally identify the following parts of the apparatus:
1. Firm Table	1. Firm Table
2. Stand	2. Stand
3. Filling Hopper	3. Filling Hopper
4. Weighing Beam	4. Weighing Beam
5. Overflow Pan	5. Overflow Pan
6. Stroker	6. Stroker
After viewing the film, the student should be able to perform the tasks described and shown in the film which include:	The student will be asked to perform the tasks shown and described in the film. These tasks include:
1. Balance the Stand	1. Balance the Stand
2. Close the Valve	2. Close the Valve
3. Center the Hopper	3. Center the Hopper
4. Open the Valve	4. Open the Valve
5. Stroke off Excess Corn	5. Stroke off Excess Corn
6. Place Test Kettle on Hook	6. Place Test Kettle on Hook
7. Balance Beam	7. Balance Beam
8. Determine Test Weight Per Bushel	8. Determine Test Weight Per Bushel

Since the content of the measuring instrument matches the content of the behavioral objectives, the measuring instrument was considered to have content validity.

Determination of the Reliability of the Measuring Instrument

Reliability can be approached in three ways:

1. If the same students are measured with the same measuring instrument or a comparable instrument, will the same results occur?
2. Are the measures obtained the "true" measures of the property being measured?
3. How much error of measurement is there in the measuring instrument?

Each of these approaches shall be expanded as follows:

The first approach implies stability, dependability, and predictability of the measuring instrument. It is assumed that if the same students were measured again, or even a similar group of students, the measuring instrument would give the same results given allowances for instrumentation.

The second approach asks if the scores attained by the students are the true measures of the property being measured? It is assumed that the performance tasks prescribed in the measuring instrument are concurrent with the expected behavioral objectives. But this particular measuring instrument also depends upon the human judgment of the scorer who observes the student's performance and assigns a numerical score to that performance. In order to assure the examiner's judgment was accurate and reliable, the following procedures were followed:

A. The examiner spent several hours practicing the tasks required by the measuring instrument. He also participated in the production of the film in order to become intimately acquainted with the exact procedures necessary to correctly perform the tasks set forth by the measuring instrument and to identify deviations from the correct procedure.

B. After this phase and prior to the collection of the data, the examiner and two individuals familiar with the study and the measuring instrument, observed three students view the film and perform the tasks listed on the measuring instrument. The three individuals viewed the student at the same time and scored the student's performance. An analysis of the three scores showed consistent agreement. Therefore, it was concluded that the examiner's judgment was accurate and reliable.

Any measuring instrument has a certain degree of measurement error. Systematic error is more serious than random error in that it tends to provide scores that are all high, all low or all average. Within the limitations prescribed by the available financial and human resources, it was not possible to identify the degree of systematic variance and, therefore, assumed to be of little, if any, influence on the scores of the student.

Random error is self-compensating and since the students from the control and experimental group were not treated any differently during the experiment, it is assumed the random error was of little, if any, consequence in this study.

Development of the Motion Picture Modalities

Using the measuring instrument, the Cooperative Reading Test, and College Placement Test scores of the previous years Institute of Agricultural Technology students, a script and scene outline were developed for the demonstration. The Editor of Interstate Printers and Publishers assisted with the development of the script to insure that the words and sentence length of the descriptive modalities were at the level of the students' ability as shown by reading and placement test scores.

A 2-inch by 2-inch color slide presentation was developed with the assistance of the Interstate Editor and Walter McCarley, Assistant Instructor, Agricultural Education Service, Michigan State University. This 35 slide presentation was shown to 27 teachers of agriculture at the Texas and Indiana Conference of Vocational Education and three beginning Michigan teachers of agriculture.

Using the appropriate suggestions from these agricultural teachers and additional suggestions from Dr. Raymond M. Clark, Michigan State University Instructional Materials Specialist in Agricultural Education, Mr. Walter McCarley, and Mr. Narindar S. Gill, Graduate Student in Agricultural Extension and Administration, a preliminary filming sequence was developed. This filming sequence, along with the purpose and procedures of the experiment, was presented to the Film Production Unit, Instructional Media Center, Michigan State University. The Film Production Unit developed the shot sequence, filmed the procedures as demonstrated by the investigator, edited the film, and prepared the final prints with close consultation and approval of the study's investigator.

The resulting products were two 16mm motion pictures, each approximately 250 feet long. The two films were identical except in the auditory modality, the descriptive terminology was audio and in the visual modality, the descriptive terminology was in caption form. The auditory and visual descriptive terminology occurred during the same film frame.

Data Collection

Procedure

The participating students' daily class schedules were obtained from the Institute of Agricultural Technology and each student's free periods were identified. The students were scheduled to participate during one of their free periods without consideration of their being a member of the control group or of the experimental group.

Prior to the mailing of the letters requesting their cooperation, the design, the purpose, and the potential contribution of the study to instructional practices were explained to the population. Starting four days after this meeting, letters were sent to the scheduled students three days before their participation date. Appendix B contains a facsimile of the letter. The students participated in the experiment during the hours of 10:00 a.m. to 12:00 p.m.; between 2:00 p.m. and 6:00 p.m. and during the evening hours of 6:00 to 10:00 during a nine-day period in November, 1967.

All the students viewed the motion picture modalities in a dormitory office arranged to simulate a small classroom. This office was located in the dormitory complex where the students lived while attending classes. A 16mm motion picture projector, normally used in classroom instruction, was used for projecting a 30 inch by 34 inch picture on a neutral-light colored wall. The exact position of the student, projector, investigator, and the weight per bushel tester is shown in Appendix C.

The procedure followed in the examination room is described below:

1. The examiner engaged the student in one minute of "small talk" while the student removed his coat and sat down in the designated chair.

2. The purpose of the study and how it related to the possible improvement of teaching at the post-high school level was explained to the student.

3. The film's basic content was outlined and the student was told that after viewing the film he would be asked to identify the parts of the apparatus shown in the film, select a sample of corn, and determine the test weight per bushel using the steps described and shown in the film.

4. The pre-threaded projector was turned on at the "focus" frame and no discussion was held during the projection of the film.

5. After running all the film through the projector, the student was taken to the weight per bushel tester and given 45 seconds to become familiar with the equipment and mentally think through the procedural steps.

6. After 45 seconds, the student was asked to verbally identify the equipment parts identified in the film. The examiner placed his hand or finger on each part, following the sequence as shown in the film, and asked, "What is the name of this part?"

7. Then the examiner asked the student to select a container of corn from the four containers, labeled one quart, one and 1/8 quart, one and 1/4 quart, and one and 1/2 quart and following the steps described and shown in the film, to determine the test weight per bushel.

8. When the student had determined the test weight, he was asked to pour the corn back into the container, thanked for his cooperation, escorted to the door, and then his scores were recorded.

Analysis

As previously stated, an experimental study determines if a statistical relationship exists between the independent variables and the dependent variable. And a commonly used statistical procedure for this purpose is the analysis of variance. The formula used for the analysis

of this study's data is described in Fred N. Kerlinger's Foundations of Behavioral Research section on "Computation of One-Way Analysis of Variance". (8:196)

Chapter III

Findings and Conclusions

This study sought to determine if there was a statistically significant difference at the .05 level between the visual and auditory motion picture descriptive modalities. This chapter answers that question.

Operational Hypothesis Number One

Operational Hypothesis Number One stated:

> The group of students viewing the visual motion picture descriptive modality will have a significantly higher mean score, at the .05 level, than the group viewing the auditory motion picture descriptive modality as judged by verbal responses to questions of apparatus identification posed by the examiner following Part I of the measuring instrument.

The control and experimental group mean, median, standard deviation, and range of scores on Part I of the measuring instrument, which coincide with Operational Hypothesis Number One are shown in Table III.

Table III Mean, Median, Standard Deviation, and Range of Scores on Part I of the Measuring Instrument

Group	Mean	Median	Standard Deviation	Range
Control	32.2	35.0	13.27	0-55
Experimental	38.3	39.7	8.77	15-55

Table III indicates a difference of 6.1 points between the two means and in order to determine if this difference was significant at the .05 level, the data were analyzed using one-way analysis of variance. Table IV shows the results of that analysis.

Table IV Analysis of the Means on Part I of the Measuring Instrument

Source	df	Sum of Squares	Mean Sum of Squares	F Value (1,58)
Between Groups	k-1 1	570	570	4.2*
Within Groups	N-k 58	7801	134.5	
Total	N-1 59	8371		4.0*

An F value of 4.2 is significant at the .05 level and therefore, the null hypothesis, $H_o = \mu_c \geq \mu_e$ is rejected. The alternative hypothesis $H_1 = \mu_c < \mu_e$ is accepted as is the operational hypothesis. Consequently, it is concluded that when using motion pictures to teach the names of the parts of the apparatus used in the perceptual-motor skill, the visual modality is more effective than the auditory modality.

Operational Hypothesis Number Two

Operational Hypothesis Number Two stated:

> The group of students viewing the visual motion picture descriptive modality will have a significantly higher mean score, at the .05 level, than the group viewing the auditory motion picture descriptive modality as determined by immediate imitation of the tasks described and shown by the motion picture and judged by the examiner following Part II of the measuring instrument.

The control and experimental group mean, median, standard deviation, and range of scores on Part II of the measuring instrument, which coincide with Operational Hypothesis Number Two, is shown in Table V.

Table V Mean, Median, Standard Deviation, and Range of Scores on Part II of the Measuring Instrument

Group	Mean	Median	Standard Deviation	Range
Control	83.5	85.1	8.77	50-90
Experimental	84.7	85.1	5.62	65-90

Table V indicates that there is a very small difference between the means of the two groups. To determine if this difference was significant at the .05 level, the same analysis as followed for Part I of the measuring instrument was used. Table VI shows the results of the analysis.

Table VI Analysis of the Means on Part II of the Measuring Instrument

Source	df		Sum of Squares	Mean Sum of Squares	F Value (1,58)
Between Groups	k - 1	1	21	21	.38
Within Groups	N - k	58	3,254	56	
Total	N - 1	59	3,275		4.0*

An F value of .38 does not indicate a statistical difference at the .05 level and therefore, the null hypothesis, $H_o = \mu_c \geq \mu_e$ is not rejected. The alternative $H_1 = \mu_c < \mu_e$ is rejected as is the operational hypothesis. It is concluded that when using motion pictures to teach perceptual-motor skills resembling those used in determining the test weight of cereal grains, the descriptive supporting modality that supplements the demonstration of the skills may be in either visual or auditory form.

Relationship Between Student Characteristics and Performance Scores

In order to determine if the student's scores on the College Placement test and the Differential Aptitude test could be used to predict their perceptual-motor skill performance, the Pearson Product-moment correlation coefficient was calculated for each appropriate relationship. The control and experimental group coefficients are shown in Table VII.

Table VII Control and Experimental Group Coefficients

Independent Variable	Part I of the Measuring Instrument		Part II of the Measuring Instrument	
	Control	Experimental	Control	Experimental
College Placement Test Scores...MSU Norms	.05	.22	.02	—.22
College Placement Test Scores...NF Norms	.27	.32	.78	—.09
Differential Aptitude Test Scores...Numerical	.25	.22	.83	.17
Differential Aptitude Test Scores...Mechanical	.10	—.13	—.07	.35

Assuming that a correlation coefficient of .5 and larger indicates a positive correlation between two variables and that a coefficient of .49 and smaller indicates there is not a correlation, the following conclusions are presented.

There is no relationship between the control and experimental group College Placement and Differential Aptitude test scores and the performance as measured by the measuring instrument with the following exception.

> There is a positive correlation between level of students' scores on the College Placement Test...NF Norms...and the numerical section of the Differential Aptitude test and their performance as measured by Part II of the measuring instrument.

It was not within the scope of this study to determine why or why not there was a correlation but only to determine if a correlation existed. Therefore, the writer concludes that one cannot predict a student's score on perceptual-motor tasks by his performance on the College Placement.

Chapter IV

Implications and Recommendations

Implications

The implications of this study shall be divided into implications for (1) information transmission theory, (2) instructional materials development, and (3) instructional media and materials utilization.

Information Transmission Theory

One cannot categorically state that the eye is more efficient than the ear for assimilating information because the type of information being transmitted often requires a specific modality. The problem, however, becomes meaningful when the information to be transmitted can be coded in two ways, auditory or visually. As stated in the review of literature, there is disagreement as to the comparative effectiveness of either modality when transmitting verbal material. And since there were not any studies known to the investigator that have investigated the comparative effectiveness of the two modalities in teaching perceptual-motor skills, the question until now has remained largely unanswered.

"One robin does not make a spring", nor does one study established facts upon which to accept or reject theoretical models of information transmission. But this study does provide a "bench-mark" to which the findings of other studies can be compared.

Implications for Instructional Material Development

The findings of this study imply that when using filmic methods for teaching the type of perceptual-motor skills used in this study, the visual modality is more effective than the auditory modality in teaching object identification. When teaching specific motor tasks, the type of descriptive modality does not appear to make any difference in the subsequent performance of the task. Therefore, in developing films that include object identification and demonstration of motor tasks, the visual descriptive modality may be used for the entire demonstration without reducing the effectiveness of the film.

The preceding findings and conclusions have far reaching implications for the design of instructional motion pictures for use in teaching perceptual-motor skill development. For if we assume that (1) the cost of producing visual modalities is less than producing audio modalities because of equipment and labor costs, and (2) less technical ability is required to produce visual modalities, teachers and their students can produce their own perceptual-motor skill demonstration films. This can encourage student-teacher planning, production, and evaluation which contributes to the growth of the student and the growth of the teacher.

If the vocational instructor is unable to produce perceptual-motor demonstration films, the commercial cost of visual film modalities and the projection equipment is usually less than for audio modalities. Therefore, the vocational instructor is able to purchase more instructional units for each tax dollar.

Also, if the content of the film does not require sound as a part of that which is being taught by the film, why go to the expense and effort of producing a sound motion picture? The same rationale is true for the design and development of filmstrips and 2 inch square slide modalities.

Implications for Instructional Media and Materials Utilization

The use of visual descriptive films, as suggested by this study, has the following implications:

1. Visual modality films can be used at individual study positions in a classroom or laboratory without raising the existing organized noise level.
2. When students in a given study location are using different demonstration films without access to ear phones, each study can use such films without being confused by sounds of other films. Thus, each student sees only what is relevant to his unit instead of hearing information that may have been covered or information that is to be covered.
3. When using 8mm film and 8mm film projection equipment, silent projectors are more economical than sound projectors thus enabling more projection units to be purchased with a specified sum of money.
4. When using filmstrips, there is no need for records, audiotapes, and similar equipment to serve as the auditory carrier. This reduces equipment cost, eliminates some storage and maintenance problems, and eliminates the need to teach the learner

how to operate the audio equipment.

Recommendations

Although research is designed to answer the questions being asked, it also raises questions for additional investigation. The following recommendations for additional investigation are divided into two parts: general recommendations and specific research hypotheses.

General Recommendations

1. This study should be replicated using a population similar to the one used in this study and also with a population that is not similar. The use of a similar population would contribute to the validity of this study and the use of a dissimilar population would determine if the subject of the demonstration film was or was not a contributing factor to the students' scores.
2. The basic hypothesis, audio versus visual modalities, should be investigated using different perceptual-motor tasks.

Research Hypotheses

1. What is the comparative effectiveness of teaching perceptual-motor skills using (a) audio descriptive modalities, (b) visual descriptive modalities, and (c) audio-visual descriptive modalities?
2. What influence do the following independent variables have on

the effectiveness of visual, audio, or audio-visual modalities?

a. Grade Point Average

b. Reading Ability

c. Intelligence Quotient

3. There is no difference in the effectiveness of each of the modalities when measured by immediate imitation and delayed imitation.

4. Meaningful, familiar information is more effectively presented through auditory modalities than through visual modalities.

5. Meaningless, unfamiliar information is more effectively presented through visual modalities than through auditory modalities.

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Appendix A

Measuring Instrument

Introduction

After the student has viewed the motion picture, the examiner will administer the criterion examination. The equipment used for the examination will include a (1) Weight Per Bushel Tester, (2) four containers, filled with yellow corn, with labels on the outside of the container indicating either (a) 1 quart, (b) 1 1/8 quarts, (c) 1 1/4 quarts, or (d) 1 1/2 quarts. The examination will consist of two parts: (1) identification of apparatus' parts as shown and described in the motion picture and (2) actual student demonstration of the tasks described and demonstrated in the motion picture.

Part One

Instructions:

After the student has become familiar with the apparatus, the examiner states that he will ask the student to identify the parts of the apparatus in the same order as shown in the motion picture. The examiner will further state that the subject will be expected to verbally reply, using the terminology mentioned in the motion picture, when the examiner places his hand on or points to a specific part and says, "What is the name of this?" The examiner will start with "firm table" and ask the student to identify the parts following the order shown in the film. The examiner will score the student based on the following standards.

Standard:

Item	Response		
	Correct 10 Points	Partially Correct 5 Points	Incorrect 0 Points
Firm Table	Firm table	Strong table, Level table, Table.	Anything different than the first two response categories
Stand	Stand	Weight per bushel, Tester.	Anything different than the first two response categories
Filling Hopper	Filling hopper	Hopper, Funnel.	Anything different than the first two resonse categories
Weighing Beam	Weighing beam	Weighing balance, Weighing bar.	Anything different than the first two response categories
Overflow Pan	Overflow pan	Pan.	Anything different than the first two response categories
Stroker	Stroker	Wooden stroker, Stick.	Anything different than the first two response categories

Part Two

Instructions:

After the student has completed Part One, the examiner will ask the subject to determine the test weight per bushel of one of the four corn samples. The student will be asked to select the correct quantity, as stated in the motion picture, to determine and state a numerical figure which indicates the test weight per bushel of that sample. The examiner

will score the student's performance, based on the performance standards listed below.

Standards:

Task	Response		
	Correct 10 Points	Partially Correct 5 Points	Incorrect 0 Points
Stroking	Student uses three equal strokes to stroke the corn off the test kettle.	Student has one equal stroke but the other two strokes are unequal.	No strokes are equal to 1/3 the diameter of the kettle.
Place kettle on the hook	Student holds the kettle in one hand, raises the handle with the other hand and places the test kettle on the hook without spilling a kernal of corn.	Student raises the handle of the test kettle while raising the test kettle to the hook. Does not spill any corn.	Moves the kettle around before raising the handle, spills some corn and jars the entire stand when attempting to hook the test kettle to the beam.
Balance Beam	Beam floats between "0" and one mark on each side of "0".	Beam floats between two marks on each side of "0".	Beam floats between three or more marks on each side of "0".
Determine Test Weight	Adds the total on the two beams and places the weight shown on the beams on the supplied form.	The number placed on the form exceeds the correct total by not more than one-tenth, plus or minus.	The number placed on the form differs from the correct total by more than two-tenths, plus or minus.

Standard:

Task	Response		
	Correct 10 Points	Partially Correct 5 Points	Incorrect 0 Points
Leveling of Stand	Bubble does not touch inner black ring.	Bubble touches but does not exceed inner black ring.	Bubble exceeds inner black ring.
Filling the Hopper	Student closes hopper valve before pouring corn into hopper and does not spill any corn.	Student starts to pour corn into open hopper, stops, closes valve, and finishes pouring corn into hopper.	Pours all corn into open hopper and attempts to close valve after all corn is in the hopper.
Centering Hopper	Student pulls hopper to stop position and checks to see if centered before opening valve.	Student pulls hopper to stop position and does not check if it is centered before opening valve.	Hopper is not centered over test kettle when valve is opened.
Opening Valve	Student opens valve quickly and completely and valve does not obstruct flow of grain into test kettle.	Student opens valve at slow, or medium speed and valve obstructs flow of grain until student opens valve completely.	Student fails to open valve completely and valve restricts flow of grain into test kettle.
Holding Stroker	Student holds stroker with both hands, places it on side of kettle without moving test kettle, checks to see if side of stroker is vertical and keeps stroker vertical during entire stroking operation.	Student holds stroker with both hands, moves kettle when placing stroker on test kettle, checks to see if vertical but does not keep it vertical during the stroking operation.	Anything that does not coincide with the first two responses.

Appendix B

Letter Sent to Students Requesting Their Participation in the Study

November 10, 1967

Dear John:

You have been selected as one of the 60 Agricultural Production students to determine the value of motion pictures in developing agricultural skills. Because of your background and interest in agriculture, you are an ideal individual to help improve the quality of agricultural instruction.

Your cooperation is vital and the experiment will take about 12 minutes of your time. It will consist of viewing a $5\frac{1}{2}$ minute motion picture and indicating your reaction to the film.

The experiment will take place in Room 201, Bryan Hall. Please come to Room 201 on ....

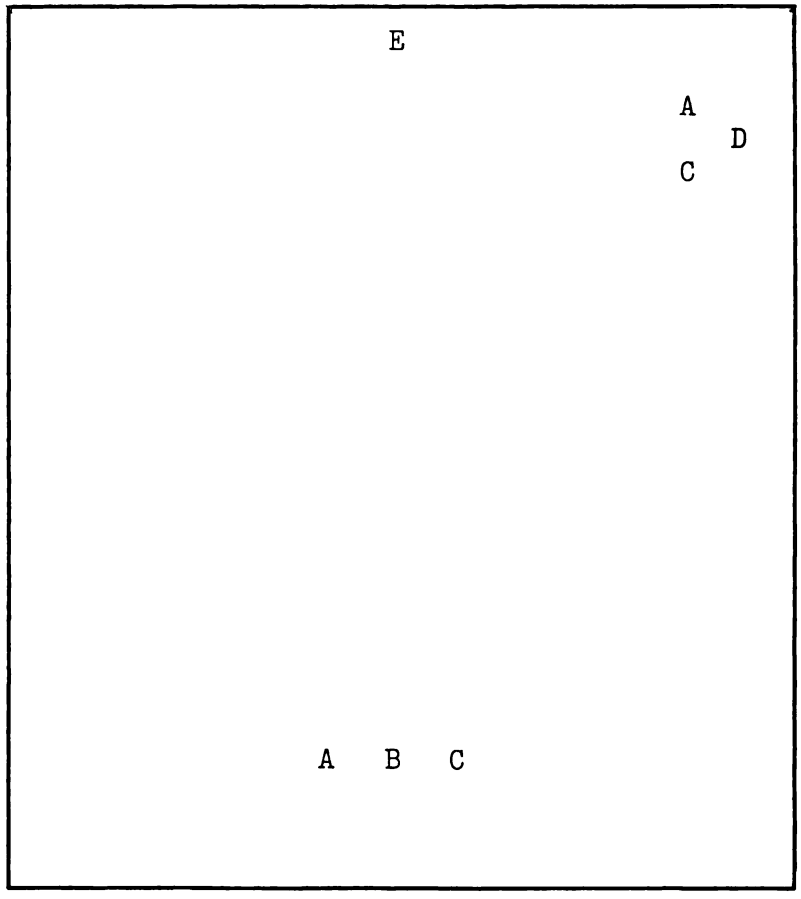
Sincerely,

Jim Hannemann

JH/cv

Appendix C

Data Collection Room Arrangement



Scale
¼ inch = 1 foot

Legend:

A = Student

B = 16mm Projector

C = Examiner

D = Weight Per Bushel Tester

E = Screen